4-1-2019

Identity and disease cycle of a smut fungus on wiregrass in a longleaf pine-grassland ecosystem in the Southeastern USA

Abeer Alqurashi
Clemson University

Julie Kerrigan
Clemson University

Kyryll Savchenko
Washington State University

Joan Walker
USDA Forest Service, Southern Research Station, Clemson SC

Identity and disease cycle of a smut fungus on wiregrass in a longleaf pine-grassland ecosystem in the Southeastern USA

Abeer Alqurashi[1], Julia Kerrigan[1], Kyryll Savchenko[2] and Joan Walker[3]

[1]Clemson University, [2]Washington State University and [3] USDA Forest Service, Southern Research Station, Clemson, SC

Background

A smut fungus that hinders wiregrass restoration efforts in longleaf pine-grassland ecosystems is being investigated in two species, *Aristida stricta* and *A. beyrichiana,* in North Carolina, South Carolina and Florida. These perennial bunchgrasses dominate these ecosystems along with longleaf pine, *Pinus palustris* (Figure1). The total area of these valuable forests has been significantly decreased due to human activities. Because of their importance, an increased interest in re-establishing the groundlayer has been seen.

For years ago, these ecological systems became adapted to frequent surface fires that provide a suitable environment for plants to grow (Figure 2). The fire-adapted wiregrass plays an important role in conserving the health of this ecosystem and its continued production has become a priority for land managers in order to maintain these treasure forests. Thus, identifying this fungus, is the first step of many processes in understanding how to control it to preserve these endemic grasses. The second objective of this study is to determine if the same fungus infects both wiregrass species.

Figure 1. Wiregrass in the groundlayer in Longleaf pine forest in SC

Figure 2. Supervised burning in longleaf pine forest for the groundlayer

Materials and Methods

Site and sampling procedure

Specimens were collected from 6 locations in South Carolina, North Carolina and Florida during 2017 and 2018.

Morphological identification

Light Microscopy (LM) and Scanning Electron Microscopy (SEM) were used to examine sorus morphology and teliospore ornamentation.

Molecular identification

DNA was extracted from cultures using a Qiagen DNeasy Plant Mini Kit. Two nuclear rDNA genes, internal transcribed spacer (ITS) and the large subunit (LSU), were targeted for amplification and sequencing.

Results and Discussions

This fungus was initially identified as *Langdonia* sp. since it is only a parasite on *Aristida* sp., replacing most of its seeds (Figure 3). Eight species of this genus were described as lacking columellae and sterile cells (McTaggart *et al*., 2012). These two characteristics have not been observed in the smut under study.

Figure 3. Smut sori replacing wiregrass seeds

Unlike the other species of this genus, the spores are single, globose, subglobose or ellipsoidal and yellowish brown colored (Figures 4 and 5). Walls are uniformly thick with dense conical spines (Figures 6 and 7). Apparently, the teliospores morphology from both plant species is undistinguishable.

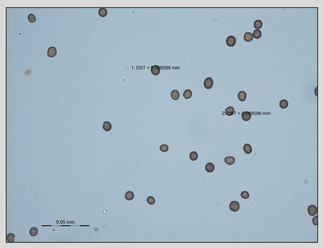

Figure 4. Teliospores from *A. Stricta* in LM

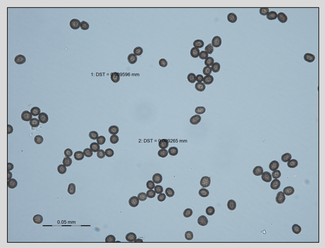

Figure 5. Teliospores from *A. beyrichiana* in LM

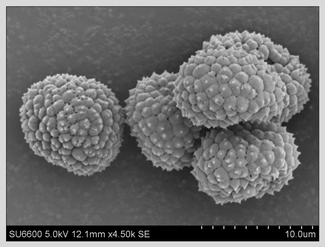

Figure 6. Teliospores from *A. stricta* in SEM

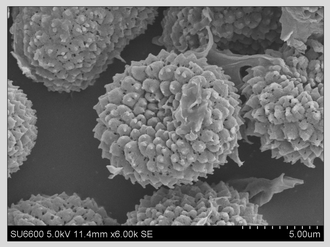

Figure 7. Teliospores from *A. beyrichiana* in SEM

For molecular identification, DNA sequence data from the two loci, ITS and LSU were assessed using Bayesian inference to construct a phylogenetic tree that shows their relationship to other genera and species in the family Ustilaginaceae (Figure 8). They are cluster in a clade with *Langdonia inopinata* which has been recently described on *Aristida adscensionis.* However, the morphological characteristics of this fungus is relatively different than the smut under study.

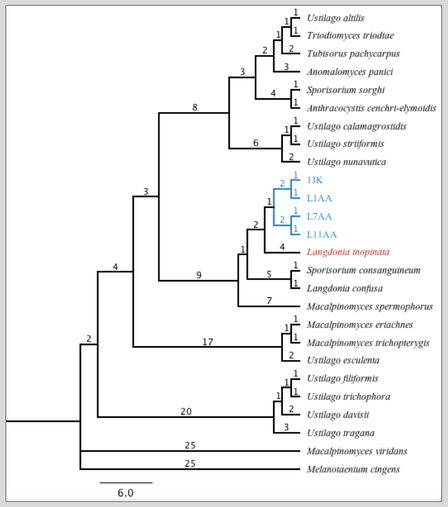

Figure 8. Phylogenetic tree for the smut under study

Conclusion

- The smut fungus that infects wiregrass in longleaf pine ecosystems was identified as *Langdonia* sp.
- Based on microscopic examination and comparisons of DNA sequences of the ITS and LSU regions, this is a previously undescribed species of *Langdonia*.
- According to morphological characteristics, the same smut infects both *Aristida* species, *A. stricta* and *A. beyrichiana*.

Future Research

- Continue working on molecular identification
- Describe the new species of *Langdonia*.
- Investigate the disease cycle of the pathogen which might help develop strategies for managing the disease.

References

1. McTaggart A.R. et al. (2012) Taxonomic revision of *Ustilago*, *Sporisotium* and *Macalpinomyces*. Persoonia 29:116-132.

Contact Info: aalqura@clemson.edu